PEACE/WILLISTON
FISH & WILDLIFE
COMPENSATION
PROGRAM

BC hydro

BRITISH COLUMBIA

A Reconnaissance Survey Of Jack Lake

M. J. Hunter
March 1997

PWFWCP Report No. 156

The Peace/Williston Fish & Wildlife Compensation Program is a cooperative venture of BC Hydro and the provincial fish and wildlife management agencies, supported by funding from BC Hydro. The Program was established to enhance and protect fish and wildlife resources affected by the construction of the W.A.C. Bennett and Peace Canyon dams on the Peace River, and the subsequent creation of the Williston and Dinosaur Reservoirs.

Peace/Williston Fish and Wildlife Compensation Program, 1011 Fourth Ave. 3rd Floor, Prince George B.C. V2L 3H9

Website: *www.bchydro.bc.ca/environment/initiatives/pwcp/*

This report has been approved by the Peace/Williston Fish and Wildlife Compensation Program Fish Technical Committee.

Citation: M. J. Hunter. March 1997. A reconnaissance survey of Jack Lake. Peace/Williston Fish and Wildlife Compensation Program, Report No. 156. 30pp plus appendices.

Author(s): Mark J. Hunter[1]

Address(es): [1] Peace/Williston Fish and Wildlife Compensation Program, 1011 Fourth Ave., 3rd Floor Prince George, B.C. V2L 3H9

A RECONNAISSANCE SURVEY OF

UNNAMED LAKE (JACK LAKE)

WATERSHED:	**Finlay River**
DATE OF SURVEY:	**August 13, 1996**
FIELD CREW LEADER:	**Mark Hunter**
FIELD ASSISTANT:	**Karin Mathias**
REPORT PREPARED BY:	**Mark Hunter**

BRITISH COLUMBIA CONSERVATION FOUNDATION

PEACE / WILLISTON FISH AND WILDLIFE COMPENSATION PROGRAM

B. C. MINISTRY OF ENVIRONMENT, LANDS AND PARKS

FUNDED BY: FOREST RENEWAL BRITISH COLUMBIA

RELEASED BY: _____

D. J. Cadden, Regional Fisheries Biologist

LAKE: Unnamed Lake (Jack Lake) SYSTEM NAME: Finlay River

A.S.A.P. REFERENCE NO.: **SYSTEM NO.:** 239-2028-316-627

DATA ON FILE FOR THIS SURVEY

Location	X	Dissolved 02 / Temp. Profiles	X
Physical Data	X	Winter Dissolved 02 / Temp. Profiles	--
Bench Mark	X	Netting Record	X
Terrain Features	X	Lake Catch Summary	X
Access	X	Individual Fish Data	X
Resorts and Campsites	X	Fish Preserved	--
Other Developments	X	Stomach Analysis	X
Obstructions and Pollutions	X	Scale Reading	X
Special Restrictions	X	Location of Inventory Sites	X
Aquatic Plants	X	Photograph Directory	X
Wildlife Observations	X	Appendices	
Miscellaneous Comments	X	A: Water Chemistry Analysis	X
Lake Drainage	X	B: Tributary Stream Data	X
Fisheries Management Comments	X	C: Fish Scale Analysis	X
History of Previous Surveys	X	Bathymetric Map Reduction	X
Water Chemistry Summary	X	Bathymetric Map	--

LOCATION

Location:	approximately 13 km south-southwest of Fort Ware		
Elevation:	890M ± 10 m	U.T.M.:	
Latitude / Longitude:	57°19'26" 125'44'18"	N.T.S. Map No.:	94 - F / 5
Management Unit:	7-40	Biogeoclimatic Zone:	Boreal White & Black Spruce
Ecoprovince:	Northern Boreal Mountains	Ecoregion:	Northern Canadian Rocky Mountains
Ecosection:	Cassiar Ranges		

Drainage: Unnamed C. --> Stelkuz C. --> Stelkuz L. --> Stelkuz C. --> Russel C. --> Finlay R. --> Williston Reservoir (Finlay Reach) --> Peace R.

PHYSICAL DATA

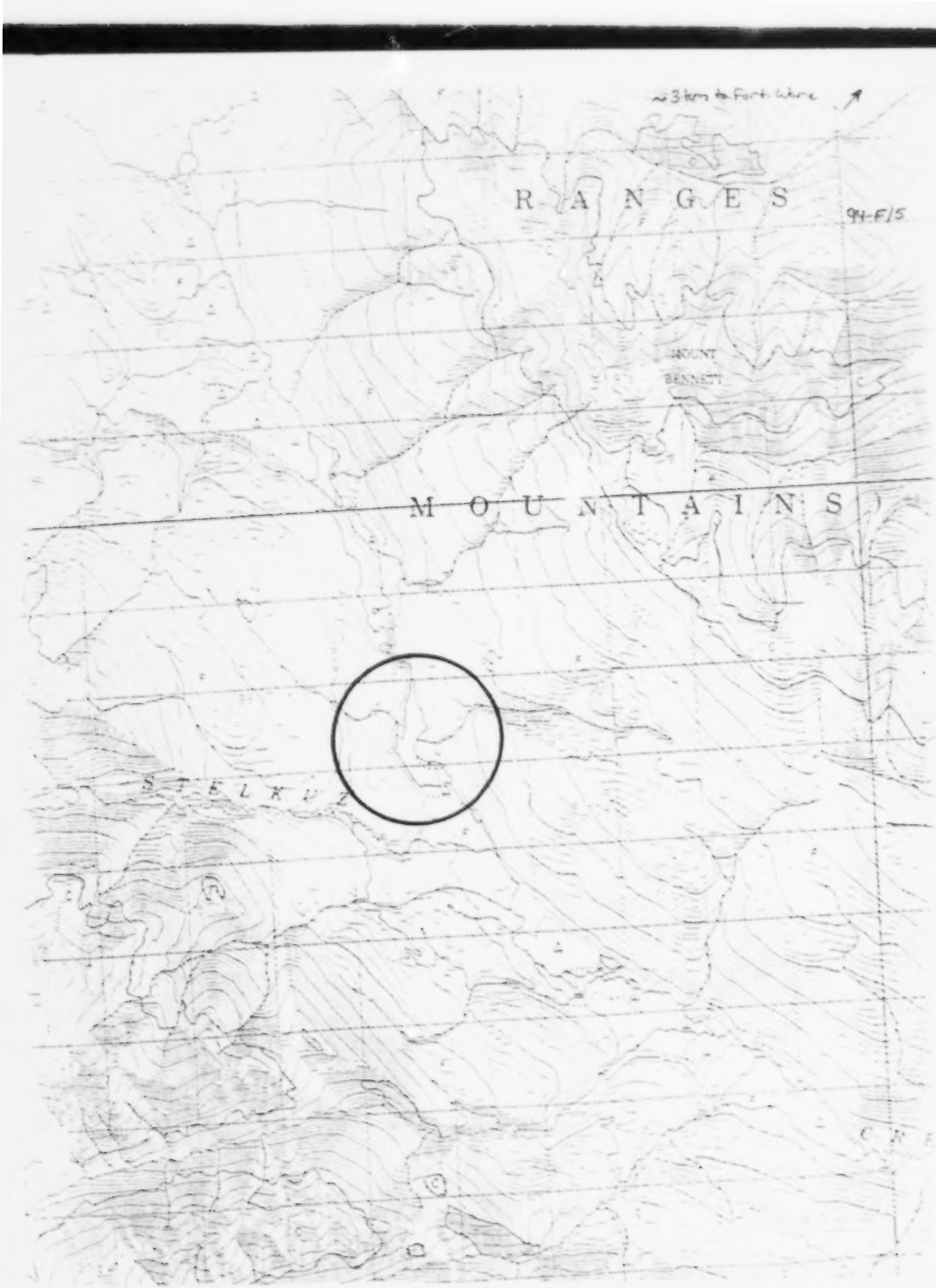
Lake Drainage Area:	11.4 km^2	Volume:	206 223 m
Water Surface Area:	89 077 m^2	Perimeter of Islands:	0 m
Area Above 6 m Contour:	88 911 m^2	Number of Islands:	0
Shoreline Perimeter:	2 294 m	Mean Depth:	2.4 m
Maximum Depth:	6.3 m	Secchi Reading:	5.45 m
Filterable Residue (TDS):	200 mg/L		

Sounding Device: Lowrance X-15 Elevation Source: Contour Interpolation

BENCHMARK

(Iron spike, center of red circle) located 2.0 m above present water level in a 25 cm diameter spruce tree that is 1.26 m from the present water's edge and located on the southwest side of the lake, directly south of beaver hut # 1 (Plate # 4).

High Water Mark: 0.2 m above water level at time of survey


~3km to Fort Selkirk
RANGES
94-F/5
MOUNT
BENNETT
MOUNTAINS
STELKVIZ

LAKE: Unnamed Lake (Jack Lake)

TERRAIN FEATURES

Immediate Shoreline:

Sedge grass and Equisetum swamps are found in the north-northwest corner and along the south and middle of the east sides of Jack Lake. Behind each of the swamps, willow and spruce trees grow on relatively flat ground. There is another sedge grass swamp found in the west corner of the lake, with willow trees growing in the marsh back from the lake's edge. Along the west side of Jack Lake, the shoreline is fronted by a growth of sedge grasses and alders with spruce, some lodgepole pine and common juniper growing behind on a slope that is very steep along the southern part of the west shore, and progressively decreases towards the north end of the lake. The southeast side of Jack Lake, between the swamps located on the south end and middle of the east side, is fronted by a growth of sedge grasses and alders with spruce and common juniper growing behind on a steep slope. North of the swamp located on the middle of the east side of Jack Lake, the shoreline is fronted by sedge grasses and alders with spruce, some lodgepole pine and common juniper growing behind on a moderately steep slope that decreases towards the north end of the lake.

The shoreline substrate in front of the swamps is composed of silts and organics; the lake's bottom has a moderately low to low slope towards the middle of the lake along these areas as well. Around the rest of the lake, the shoreline substrate is composed of fines, cobbles and boulders covered in a thin layer of silts. The lake's bottom has a moderately steep slope towards the middle of the lake along these sections of the lake. There is some large woody debris found along the west and northeast sides of the lake that could be hazardous to boaters. As well, there are five beaver huts located around Jack Lake - four on the east side and one on the west side (Plates # 5).

Surrounding Country:

Jack Lake is surrounded by a mature forest of spruce trees with some lodgepole pine intermixed. Moderately steep to steep hills to the east and west give rise to mountains in the near distance. To the northwest and southeast, the land is a relatively flat valley bottom. A clear cut is located approximately 0.5 km away to the west-northwest of the lake. As this clear cut cannot be seen from the lake, it does not detract from the aesthetic value of the lake. Jack Lake is situated within the Boreal White and Black Spruce biogeoclimatic zone.

LAKE: Unnamed Lake (Jack Lake)

ACCESS

Directions:

From the junction of Highway 97 and Highway 39, drive south on Highway 97 for approximately 1.5 km and turn right on to the Finlay Forest Service Road. Travel north for approximately 200 km to Mesilinka Camp, then continue on the Finlay-Chunamon Forest Service Road for approximately 105 km to the Ingenika Arm of Williston Reservoir. A barge must be taken across the Ingenika Arm. On the north side of the Ingenika Arm, drive north on the Finlay Forest Service Road for approximately 72.5 km. Turn left, and proceed for approximately 3.7 km to Buffalo Head Camp (Finbow Camp). . The total distance from the junction of Highway 97 and Highway 39 to Buffalo Head Camp is approximately 382.7 km. Jack Lake is approximately a 19 km helicopter ride to the west-northwest of Buffalo Head Camp.

Barge transportation can be arranged with Finlay Navigation Inc. who can be reached in Prince George at (250) 964-3525 and in Mackenzie at (250) 997-3525. The barge transportation takes approximately 20 minutes. Actual barge pick-up times may vary greatly from the predicted pick-up time.

Road Type and Conditions:

Highway 97 is a well-maintained, two-lane paved highway. The Finlay Forest Service Road, on both sides of the Ingenika Arm, and the Finlay-Chunamon Forest Service Road from 0 km to approximately 79 km (Factor Ross Creek), are well-maintained, two-lane gravel logging roads that can be easily traveled with a two-wheel drive truck. After approximately 79 km, the Finlay-Chunamon Forest Service Road becomes quite narrow and very windy. The road in to Buffalo Head Camp from the Finlay Forest Service Road is a well-maintained, two-lane gravel road.

Restrictions:

Although there are no restrictions, it is recommended that a truck radio be used when traveling on all gravel roads.

RESORTS AND CAMPSITES

There are no resorts or campsites on Jack Lake.

LAKE: Unnamed Lake (Jack Lake)

OTHER DEVELOPMENTS

There is a hunting camp that includes a fire pit and wood braces for hanging tarps located on the middle of the west side of the lake (Plate # 6).

Approximately 350 m downstream of the lake, there is abridge crossing the outlet. Beavers have started to dam the upstream side of the bridge.

OBSTRUCTIONS AND POLLUTIONS

The hunting camp located on the lake's shore was littered with the remains of several moose. This had attracted a black bear that was seen from the helicopter on August 12, 1996, the day before the survey. It appeared that the bear came to the site often as there was a large amount of bear scat all over the camp and the smell of bear was extremely strong around the area of the camp.

The bridge that crossed the outlet approximately 350 m downstream of the lake had either been poorly built, 'or the foundation on the upstream side had sunk, as the bridge was in the creek and acting as a partial dam. (Plate # 7).

SPECIAL RESTRICTIONS

None known.

AQUATIC PLANTS

The following aquatic plants were identified during the time of the survey:

Equisetum
eel grass
yellow waterlily (Nuphar sp.)
claspingleaf pondweed (Potamogeton richardsonii)
whitestem pondweed (Potamogeton praelongus)
Chara sp.
coontail (Ceratophyllum sp.)
milfoil (Myriophyllum sp.)

WILDLIFE OBSERVATIONS

The following wildlife or signs were seen during the time of the survey:

black bear (seen Aug. 12, 199[illegible] from helicopter)
moose tracks and droppings
common loon
wolf tracks
10 unidentified ducks

LAKE: Unnamed Lake (Jack Lake)

MISCELLANEOUS COMMENTS

1) The bridge that crossed the outlet approximately 350 m downstream of the lake had either been poorly built or the foundation had sunk as the bridge was in the creek and acting as a partial dam.

2) If a Forest Recreation Site was going to be built on Jack Lake, it is recommended that the hunting camp located on the west side of the lake be cleaned up. As it sits, the large amount of moose bones and bear scat attract the attention of a large black bear that could be a potential danger to anyone who camps in the area.

3) Downstream of the bridge crossing on the outlet, small, black worm-like organisms were clinging to the rocks.

4) Bathymetric map: The lake outline was drawn from an enlargement of air photo 30 BCB 92081: No. 173, flown August 1, 1992.

LAKE: Unnamed Lake (Jack Lake)

LAKE DRAINAGE

General:

Jack Lake is fed by two inlets that enter the lake in the middle of the east and west sides of the lake. The outlet drains Jack Lake from the south end of the lake, and flows for approximately 415 m to join Stelkuz Creek. Stelkuz Creek flows for approximately 18.5 km to Stelkuz Lake, then continues for an additional 2 km out of Stelkuz Lake and empties into Russel Creek. Russel Creek flows for approximately 13 km to it's confluence with the Finlay River.

Major Systems:

There are no major systems.

Minor Systems:

Inlet # 1 - Unnamed Creek

Inlet # 1 enters Jack Lake in the middle of the east shore. For the first 30 m upstream of Jack Lake, the creek flows through the swamp located on the east side of the lake. The channel has an average wetted width of 1.3 m and depth of 0.3 m. The substrate is composed of silts and fines with some gravels. The creek is confined by sedge grass covered banks with some willows growing on them back from the lake. Approximately 30 m upstream of Jack Lake, there is a 0.25 m high beaver dam over which fish passage was possible at the time of the survey. Upstream of the dam, there is some excellent spawning gravels suitable for salmonids. Also upstream of this dam, the banks composition changes to fines covered by mosses and some shrubs. Approximately 60 m upstream of the lake, there is the first of numerous small debris jams that are roughly 80% unstable. Approximately 85 m upstream of the lake, there is a set of four falls side-by-side that range in height from 0.3 m to 0.6 m. These falls were probably passable to upstream fish passage at the time of the survey. Approximately 150 m upstream of Jack Lake, there is a 0.35 m high falls created by a log that had fallen into the channel. Upstream of this point, small cobble begins to show up in the substrate. Approximately 160 m upstream of the lake, there is a 0.25 m high falls created by a fallen log. Upstream of this point, the gradient begins to slowly increase. Approximately 220 m upstream of jack Lake, there is a set of three falls, one after the other, with a total height of 1.5 m (Plate # 8). Approximately 235 m upstream of the lake, there is another falls that was 0.6 m high. Inlet # 1 had some good salmonid spawning habitat along the middle section of the length that was surveyed during the survey period.

A Stream Survey Card was completed for a sample site located approximately 80 m upstream of the lake (Plates # 9 & # 10). The average wetted width is 1.4 m and the

average maximum riffle depth is 0.24 m. The substrate is composed of gravels (65%) and fines (35%). The creek morphology is comprised of runs (40%), riffles (30%) and pools (30%), with a gradient of 3.5%. The water temperature at the time of the survey was 7 °C. For additional information, refer to Appendix B.

A Stream Survey card was completed for a second sample site located approximately 250 m upstream of Jack Lake (Plates # 11 & # 12). The average wetted width is 1.6 m and the average maximum riffle depth is 0.17 m. The substrate is composed of cobbles (50%), gravels (40%) and fines (10%). The creek morphology is mainly cascades (50%) and riffles (45%) with some pools (5%). The gradient is 9% and the water temperature at the time of the survey was 7 °C. For additional information, refer to Appendix B.

Inlet # 2 - Unnamed Creek

Inlet # 2 enters Jack Lake in the middle of the west side of the lake. Over the first 90 m upstream of the lake, the creek flows through a sedge grass swamp that has some willows growing along the sides of the channel. The channel width is 0.5 m and the average depth is 0.35 m. The substrate is composed of silts and organics. Approximately 45 m upstream of the lake, there is a 0.1 m high beaver dam that has been recently constructed. Approximately 90 m upstream of the lake, gravels start to show up in the substrate. From this point on, the creek has an average wetted width of 0.7 m and depth of 0.1 m. The undercut banks are composed of fines covered by mosses, sedge grasses, Equisetum, willows and some spruce trees growing thickly along side the creek. Starting approximately 120 m upstream of Jack Lake, there is lots of large woody debris that has fallen into the channel. Approximately 130 m upstream of the lake, the substrate is again composed completely of fines. Inlet # 2 had very limited fisheries potential during the survey period.

Outlet - Unnamed Creek

The outlet drains Jack Lake from the south end of the lake (Plate # 13). Over the first 250 m downstream of the lake, the creek flows along one side of a sedge grass swamp. The average wetted width is 4 m and the depth is 1.0 m. The substrate is composed of silts and organics. This section of the outlet is passable with the motor boat. Approximately 250 m downstream of the lake, there is a 0.7 m high beaver dam that was probably not passable to upstream fish passage at the time of the survey due to insufficient water flow over the top of the dam. Approximately 300 m downstream of the lake, there is a bridge crossing; the bridge is sitting in the creek and the base supports are catching debris and partially damming the creek. Approximately 310 m downstream of Jack Lake, the creek braids into two channels which rejoin approximately 25 m further downstream. Approximately 345 m downstream of the lake, there is a 0.15 m high debris jam that is passable to upstream fish movement. From the bridge to 400 m downstream of Jack Lake, the average wetted width is 1.5 m and the depth is 0.4 m. Downstream of 400 m, the creek widens out into a shallow pond that is 15 m wide, 60 m long and averages 0.3 m deep. Approximately 465 m downstream of the lake, the outlet drains

into Stelkuz Creek. Approximately 5 m downstream of this point, Stelkuz Creek flows over a 0.5 m high beaver dam. The substrate of Stelkuz Creek is composed of gravels fines and small cobble. Although the outlet had no fisheries potential during the survey period, there are areas of good to very good salmonid spawning and rearing habitat in Stelkuz Creek.

A Stream Survey Card was completed for a sample site on Stelkuz Creek located approximately 490 m downstream of Jack Lake (Plates # 14 & # 15). The creek has an average wetted width of 4.0 m; the average maximum riffle depth is 0.6 m and the average maximum pool depth is 0.95 m. The substrate is composed of gravels (60%), fines (35%) and small cobble (5%). The creek morphology is mainly pool (50%) and run (40%) with some riffles (10%). The gradient is 3.5% and the water temperature at the time of the survey was 9 °C. For additional information, refer to Appendix B.

LAKE: Unnamed Lake (Jack Lake)

FISHERIES MANAGEMENT COMMENTS

Jack Lake supports a small population of rainbow trout and bull trout that could support a low intensity use fishery. The summer oxygen temperature profile indicates that the dissolved oxygen levels are ample to support a fish population, as do the pH levels. There was some salmonid spawning habitat found in Inlet # 1; however, the best salmonid spawning and rearing habitat was found in Stelkuz Creek, located approximately 465 m downstream of Jack Lake. To make the spawning habitat in Stelkuz Creek more accessible to fish in Jack Lake, the beaver dam on the outlet, located approximately 250 m downstream of the lake, could be partially breached so that water is funneled through one spot for most of the year. It should be noted that there were no juvenile rainbow trout or bull trout found in Jack Lake - it could be that they can not get back into the lake over the beaver dams on the outlet. The bridge that crosses the outlet approximately 300 m downstream of the lake should be replaced. At present, the 6 x 6 railroad tie foundation is sitting in the creek, and the bridge would definitely flood over during high water in the spring. As well, the beavers had started to dam up the gaps in the foundation of the bridge, which will cause further flooding damage to the road.

HISTORY OF PREVIOUS SURVEYS

Lake Surveys:

None known.

Other Related Studies:

None known.

LAKE: Unnamed Lake (Jack Lake)

WATER CHEMISTRY SUMMARY **Limnology Station No. 1**

Field Conditions:

Date:	August 13, 1996		
Time:	1200 hrs	Air Temperature:	17.5 °C
Wind Velocity:	0 - 5 km/h	Wind Direction:	from the N
Cloud Cover:	4 / 10 o.c.	Surface Conditions:	very light ripple
Secchi Disc:	5.45 m	Water Colour:	yellow tinge

Method Used:

Dissolved Oxygen:	YSI Model 57 Oxygen / Temperature Meter
Water Temperature:	YSI Model 57 Oxygen / Temperature Meter
Air Temperature:	Hand-Held Alcohol Thermometer
pH (field):	Digital pH Pocket Tester
H2S (field):	Hach H2S Field Test Kit
Laboratory Used:	Pacific Environmental Science Center
Water Sampler:	Vertical Alpha Water Bottle (Vandorn)
Metal Sampler:	By Hand; Preserved With 2.0 mL Nitric Acid
Substrate Sampler:	Substrate Sample Not Taken

Water Sample Chemistry: **SEAM Site No.:** E 223161

	Sampling Depths	
	Surface (0.5 m)	Lower (5.5 m)
Alkalinity (lab)	183 mg/L	197 mg / L
Filterable Residue 105°C (lab)	200 mg / L	220 mg / L
H2S (field)	N/A	0.0 mg / L
Nitrogen - Total (lab)	0.24 mg / L	0.28 mg / L
Non-Filterable Residue (lab)	< 5 mg / L	< 5 mg / L
pH (field)	7.7	7.5
pH (lab)	8.34	7.92
Phosphorus - Total Dissolved (lab)	0.006 mg / L	0.005 mg / L
Specific Conductance (lab)	327 µS / cm	355 µS / cm

Bottom Depth: 6.3 m

Substrate Sample Depth: N/A

* additional analyzed parameters and results, including metals, are found in Appendix 1

LAKE: Unnamed Lake (Jack Lake)

SUMMER OXYGEN / TEMPERATURE DATA

DEPTH (m)	02 (mg/L)	TEMPERATURE (°C)
Surface	10.6	15.1
1.0	10.6	14.9
2.0	10.8	14.7
2.5	11.1	14.6
3.0	11.7	14.4
3.5	12.2	14.0
4.0	11.6	13.8
4.5	10.2	13.4
5.0	4.8	12.9
5.5	2.2	12.2
6.0	1.4	12.1
6.3	Bottom	

SUMMER OXYGEN / TEMPERATURE PROFILE

LAKE: Unnamed Lake (Jack Lake)

NETTING RECORD

Mesh Size Experimental Order: 25, 76, 51, 89, 38, 64 mm

NETTING SITE # 1

Type:	Sinking Monofilament Gill Net		
Date Set:	August 13, 1996	Time:	1010 hrs
Date Lifted:	August 13, 1996	Time:	1443 hrs
Net Dimensions:	Length: 91.4 m	Depth:	2.4 m
Shallow End Mesh Size:	25 mm	Depth:	2.0 m
		Substrate:	silts over fines & boulder with pondweed
Deep End Mesh Size:	64 mm	Depth:	5.5 m
		Substrate:	silts / clay

Comments: The net started approximately 4.0 m out from the shore.

LAKE CATCH SUMMARY

Species	Netting Site No. 1	Angled	Other	Total	Number Sampled	Number Preserved	Size Range (cm)
RB	11	0	0	11	11	0	19.2-35.4
BT	5	0	0	5	5	0	29.8-44.7
MWF	1	0	0	1	0	0	25.2
LSU	8	0	0	8	0	0	29.8-37.5

Minnow Traps:

Bait: Sardines

Trap No.	Hours	Depth (m)	Substrate	Species	No. Caught	Size Range (cm)
1	6:14	1.0	pondweed over silts	LKC	8	6.8-9.5
2	6:14	1.0	thin organics over LWD and pondweed	empty	0	-
3	6:13	1.0	thin organics over fines and Chara sp.	LKC	3	6.7-8.9
4	6:16	1.1	silt / organics with Chara sp. and Equisetum	LKC	13	5.5-9.8

LAKE: Unnamed Lake (Jack Lake)

INDIVIDUAL FISH DATA

Date Captured: August 13, 1996

Method: Sinking
Monofilament
Gillnet

M - Male
F - Female
? - Not Obvious

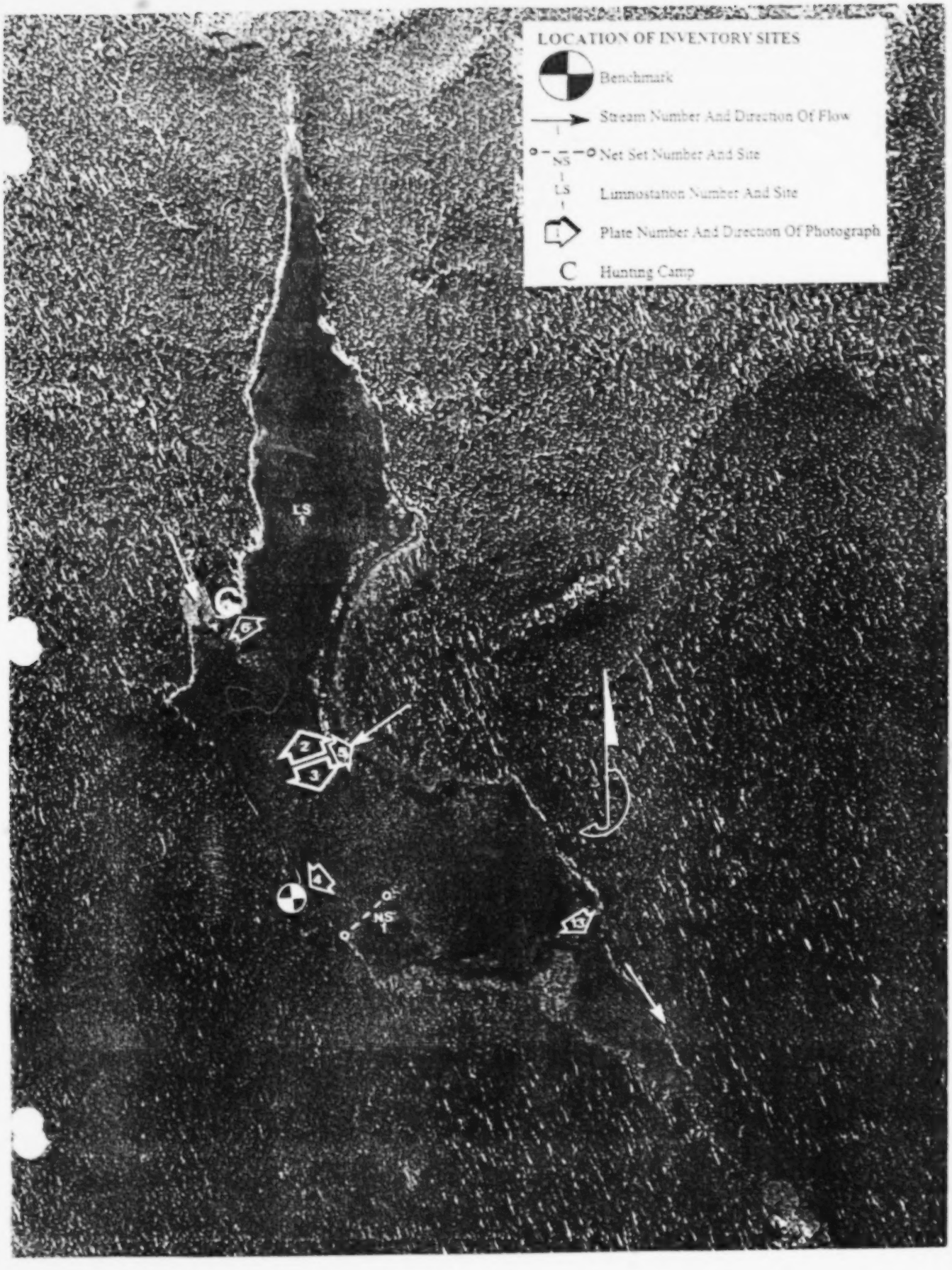
IMM - Immature
MG - Maturing
MT - Mature
GV - Gravid
SP - Spent
? - Not Obvious

EG - Egg
FR - Fin Ray
HD - Head
ML - Milt
OT - Otolith
SC - Scale

Species	Fork Length (cm)	Weight (grams)	Sex	Gonadal Maturity	Sample Type	Age (yr)	Stomach Contents				Comments
							Plankton	Insects	Fish	Other	
RB	31.2	303	M	IMM	SC		Da	B			TW in St
RB	28.0	252	M	IMM	SC		Cr	B			
RB	32.3	371	M	MG	SC		Cr				
RB	31.3	305	M	IMM	SC			Di			TW in St
RB	35.4	418	F	MG	SC			Di			L on gills and anal fin
RB	29.6	278	F	MG	SC		Da			S	cysts in St
RB	30.3	276	F	MG	SC	1	Da				
RB	33.9	410	M	IMM	SC		Da				TW in St
RB	33.6	404	M	MG	SC			DN			
RB	27.5	247	F	MG	SC		Da				TW in St
RB	19.2	92	M	IMM	SC			B			
BT	29.8	247	M	IMM	FR	7				empty	TW in St
BT	44.7	845	F	MG	FR	6*			trout		
BT	44.7	940	M	IMM	FR	12			RB		TW in St
BT	36.3	540	F	MG	FR	?				empty	TW in St
BT	31.8	326	F	MG	FR	?				empty	TW in St

B - Beetle
C - Clams
CF - Caddis Fly
Ch - Chaoborus
Cr - Chironomids
Da - *Daphnia*
Di - Diptera
DN - Dragonfly Nymph
L - Leech
Li - Lice
O - Organics
S - Snails
St - Stomach
TP - Tape Worm
WB - Water Boatman
WF - Whole Fish

* fin ray may have been cut too low, therefore age may be wrong


LOCATION OF INVENTORY SITES
Benchmark
Stream Number And Direction Of Flow
NS
Net Set Number And Site
LS
Lumnostation Number And Site
Plate Number And Direction Of Photograph
C
Hunting Camp
LS
NS
NS

LAKE: Unnamed Lake (Jack Lake)

PHOTOGRAPH DIRECTORY

Plate	Roll : Number	Description
1	16:8	Aerial view of Unnamed Lake (Jack Lake) looking north. Note the clear cut located approximately 0.5 km northwest of the lake.
2	18: 12 - 14	Panoramic view of Unnamed Lake (Jack Lake) looking north from the center of the lake.
3	18: 9 - 11	Panoramic view of Unnamed Lake (Jack Lake) looking south from the center of the lake.
4	19: 20	View of the benchmark located 2.0 m above present water level in a 25 cm diameter spruce tree that is 1.26 m from the present water's edge and located on the southwest side of the lake, directly south of beaver hut # 1.
5	18: 24	View of beaver hut # 1 and the mouth of Inlet # 1 where it enters Unnamed Lake (Jack Lake) in the middle of the east side of the lake.
6	18:23	View of the hunting camp located in the middle of the west side of Unnamed Lake (Jack Lake).
7	19:14	Upstream view of the bridge that crosses the outlet, located approximately 350 m downstream of Unnamed Lake (Jack Lake).
8	18: 2	Upstream view of the set of falls on Inlet # 1 located approximately 220 m upstream of Unnamed Lake (Jack Lake). Total falls height is 1.5 m.
9	19:22	Upstream view of sample site # 1 on Inlet # 1, taken approximately 70 m upstream of Unnamed Lake (Jack Lake).
10	19:21	Downstream view of sample site # 1 on Inlet # 1, taken approximately 90 m upstream of Unnamed Lake (Jack Lake).
11	19:23	Upstream view of sample site # 2 on Inlet # 1, taken approximately 240 m upstream of Unnamed Lake (Jack Lake).
12	19:24	Downstream view of sample site # 2 on Inlet # 1, taken approximately 260 m upstream of Unnamed Lake (Jack Lake).

LAKE: Unnamed Lake (Jack Lake)

13	18: 19	View of the mouth of the outlet where it drains Unnamed Lake (Jack Lake) from the south end of the lake.
14	19: 13	Upstream view of the sample site on Stelkuz Creek, taken approximately 500 m downstream of Unnamed Lake (Jack Lake).
15	19:12	Downstream view of the sample site on Stelkuz Creek, taken approximately 480 m downstream of Unnamed Lake (Jack Lake).

LAKE: Unnamed Lake (Jack Lake)

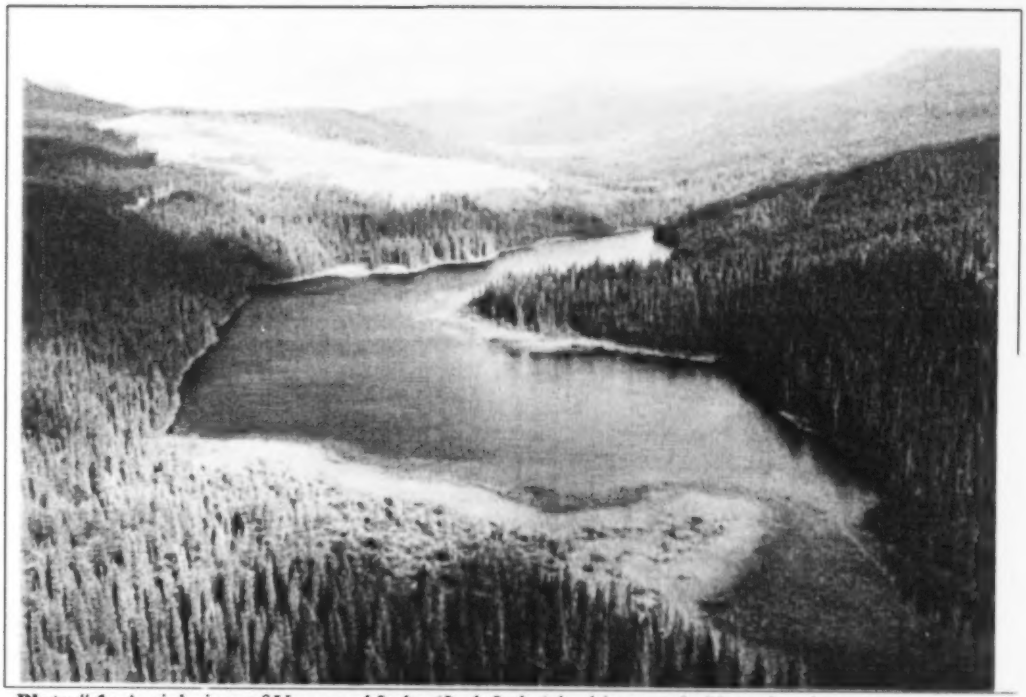


Plate # 1: Aerial view of Unnamed Lake (Jack Lake) looking north. Note the clear cut located approximately 0.5 km northwest of the lake.

LAKE: Unnamed Lake (Jack Lake)

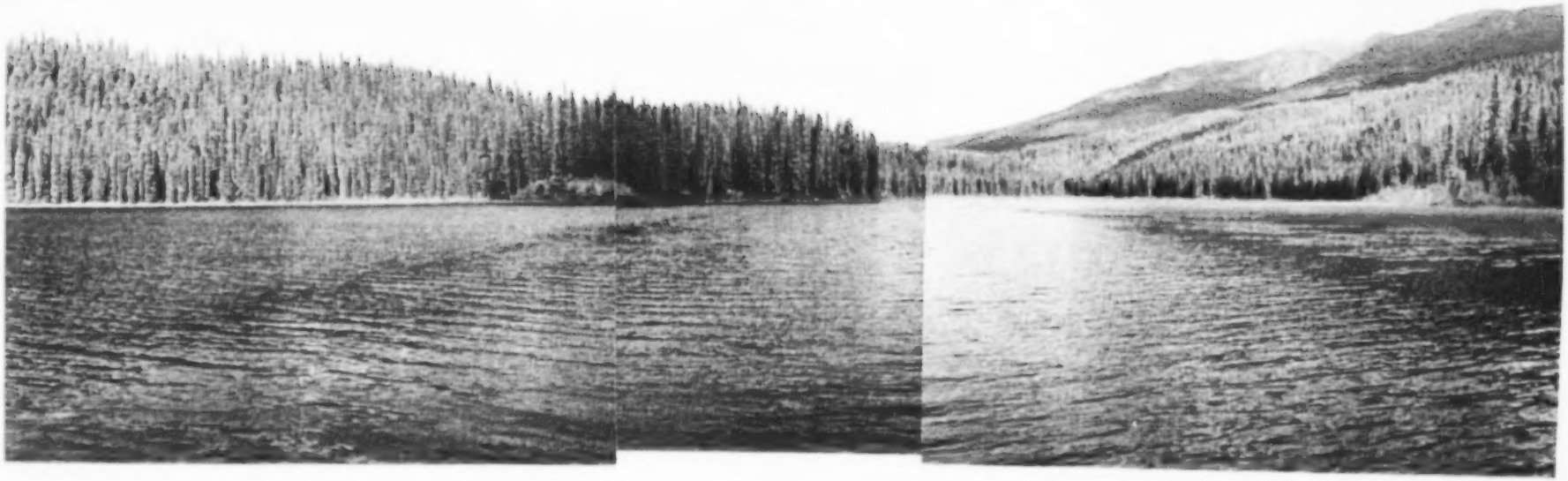


Plate # 2: Panoramic view of Unnamed Lake (Jack Lake) looking north from the center of the lake

LAKE: Unnamed Lake (Jack Lake)

Plate # 3: Panoramic view of Unnamed Lake (Jack Lake) looking south from the center of the lake

Plate # 4: View of the benchmark located 2.0 m above present water level in a 25 cm diameter spruce tree that is 1.26 m from the present water's edge and located on the southwest side of the lake, directly south of beaver but # 1.

LAKE: Unnamed Lake (Jack Lake)

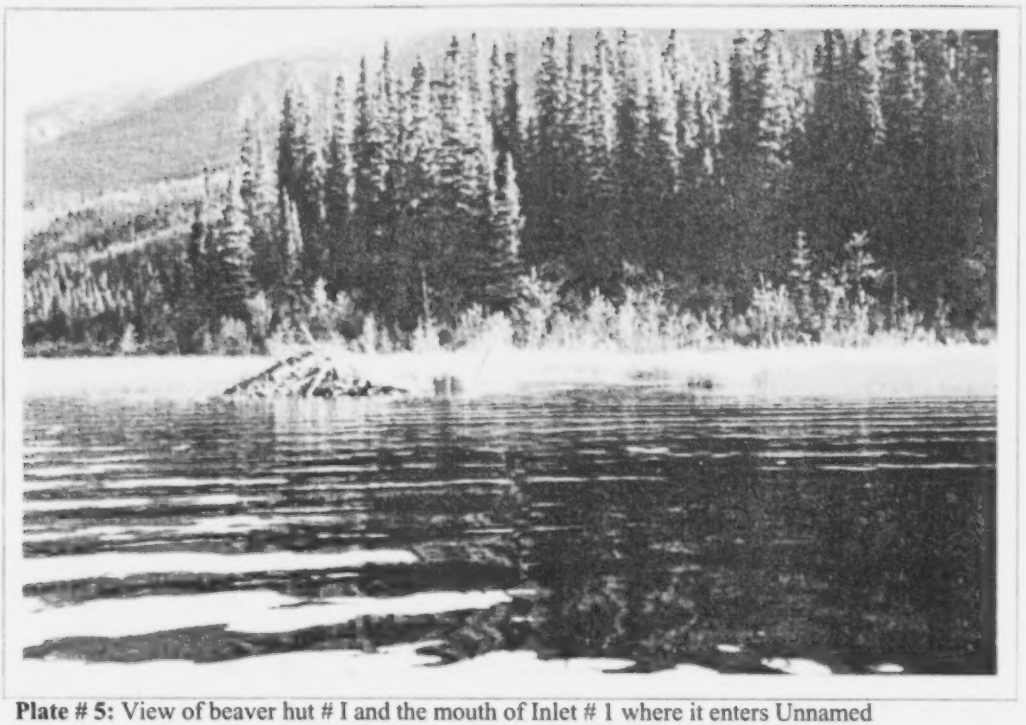


Plate # 5: View of beaver hut # I and the mouth of Inlet # 1 where it enters Unnamed Lake (Jack Lake) in the middle of the east side of the lake.

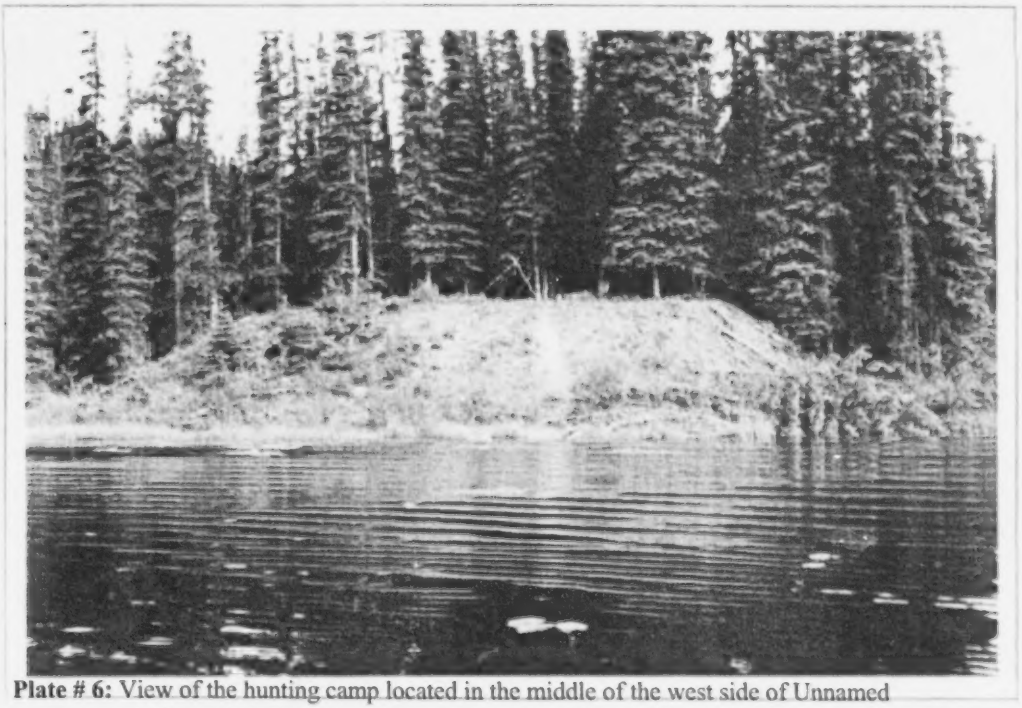


Plate # 6: View of the hunting camp located in the middle of the west side of Unnamed Lake (Jack Lake).

LAKE: Unnamed Lake (Jack Lake)

Plate # 7: Upstream view of the bridge that crosses the outlet, located approximately 350 m downstream of Unnamed Lake (Jack Lake).

LAKE: Unnamed Lake (Jack Lake)

Plate # 8: Upstream view of the set of falls on Inlet # 1 located approximately 220 m upstream of Unnamed Lake (Jack Lake). Total falls height is 1.15 m.

LAKE: Unnamed Lake (Jack Lake)

Plate # 9: Upstream view of sample site # 1 on Inlet # 1, taken approximately 70 m upstream of Unnamed Lake (Jack Lake).

LAKE: Unnamed Lake (Jack Lake)

Plate # 10: Downstream view of sample site # 1 on Inlet # 1, taken approximately 90 m upstream of Unnamed Lake (Jack Lake).

Plate # 11: Upstream view of sample site # 2 on Inlet # 1 taken approximately 240 m upstream of Unnamed Lake (Jack Lake).

LAKE: Unnamed Lake (Jack Lake)

Plate # 12: Downstream view of sample site # 2 on Inlet # 1, taken approximately 260 in upstream of Unnamed Lake (Jack Lake).

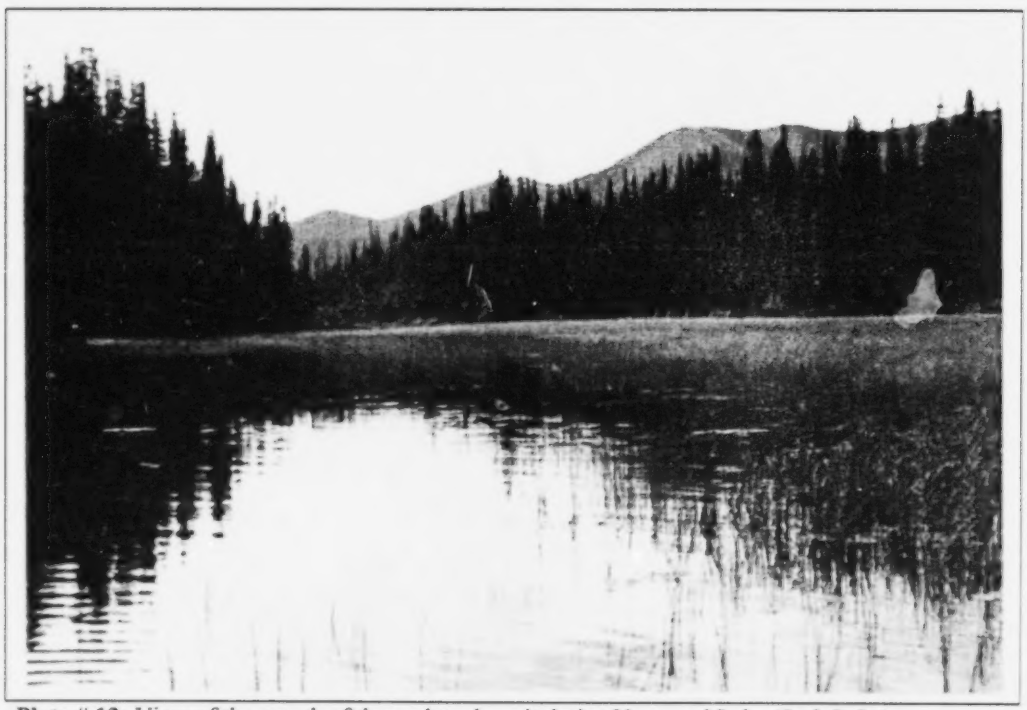


Plate # 13: View of the mouth of the outlet where it drains Unnamed Lake (Jack Lake) from the south end of the lake.

LAKE: Unnamed Lake (Jack Lake)

Plate # 14: Upstream view of the sample site on Stelkuz Creek, taken approximately 500 m downstream of Unnamed Lake (Jack Lake).

Plate # 15: Downstream view of the sample site on Stelkuz Creek, taken approximately 480 m downstream of Unnamed Lake (Jack Lake).

Appendix A

LABORATORY REPORT

Water Chemistry Analysis

RESULTS FOR UNNAMED LAKE-JACK LAKE SAMPLES

Parameter Analyzed		Units	963915-001	963915-002
ALKALINITY		mg/l	183	197
CONDUCTIVITY		uS/cm	327	355
METALS/TOTAL (WATER-ICP)	AG	mg/l	<.01	-
	AL	mg/l	.1	-
	AS	mg/l	<.06	-
	B	mg/l	<.01	-
	BA	mg/l	.11	-
	BE	mg/l	.001	-
	CA	mg/l	47.7	-
	CD	mg/l	<.006	-
	CO	mg/l	<.006	-
	CR	mg/l	.006	-
	CU	mg/l	<.006	-
	FE	mg/l	.081	-
	K	mg/l	.5	-
	MG	mg/l	16	-
	MN	mg/l	.007	-
	MO	mg/l	<.01	-
	NA	mg/l	3.7	-
	NI	mg/l	<.02	-
	P	mg/l	<.1	-
	PB	mg/l	<.06	-
	SB	mg/l	<.06	-
	SE	mg/l	<.06	-
	SI	mg/l	2.28	-
	SN	mg/l	<.06	-
	SR	mg/l	.255	-
	TI	mg/l	.012	-
	V	mg/l	<.01	-
	ZN	mg/l	<.002	-
NITROGEN/AMMONIA		mg/l	.011	.023
/NITRITE		mg/l	<.002	<.002
/NITRITE+NITRATE		mg/l	<.002	<.002
/TOTAL		mg/l	.24	.28
PH		Rel.U.	8.34	7.92
PHOSPHORUS/O-PO4		mg/l	<.001	<.001
/TOTAL		mg/l	.006	.014
/TOTAL DISSOLVED		mg/l	.006	.005
RESIDUE/FILTERABLE		mg/l	200	220
/NON-FILTERABLE		mg/l	<5	<5
BC CLIENT STUDY CODE			20	20
SAMPLING AGENCY			91	91
SITE IDENTIFIER/NUMBER			E223161	E223161
COLLECTION START DATE		y/m/d	96/08/13	96/08/13
END TIME		hhmm	NA	NA
UPPER DEPTH		METERS	0.5	5.5
TEMPERATURE ON ARRIVAL		deg.C	4	4

Appendix B

Tributary Stream Data

D.F.O. / M.O.E. Stream Survey Form

DFO / MOE

STREAM SURVEY FORM

Stream Name				Local			Access	FT	Method		
Watershed Code						Reach No.		Length (m)			
Location				Map #	94 F/5	Site No.	1	Lifeform	20	FT	
				UTM		Fish Cert.	Y / N		Field	Mist	
Date Y M D		Time		Agency		Crew		Photo(s)	Air Photos	BCR 92031 - 173	

C	PARAMETER	VALUE	METH	SPECIFIC DATA	OBSTRUCTIONS C	Ht(m)	Type	Loc'n
	Ave Chan Width (m)							
	Ave Wet Width (m)							
	Ave Max Riffle Depth (cm)							
	Ave Max Pool Depth (cm)							
	Gradient %							
	% Pool / Riffle / Rapid / Other			BED MATERIAL	%	BANKS		
	Side Chan %			Fines		Height	Substrate	
	Debris Area %			Gravels		Texture		
	Debris Slash %			Larges		Confinement	EN CO FC OC UC N/A	
	COVER Total %			Bedrock (R)		Valley Channel Ratio	0-2 2-5 5-10 10 N/A	
						Stage	Dry L M H Flood	
	Crown Closure %							

DISCHARGE				
Parameter	Value	Method	Specific Data	
Wetted Width (m)				
Mean Depth (m)				
Mean Velocity (m/s)				
Discharge (m³/s)				

REACH SYMBOL

Plan

FISH SUMMARY						
C	Species	No.	Size Range (mm)	Life Phase	Loc	Method/Ref.

STREAM VALLEY CROSS-SECTION

Looking Downstream

L R

PLANIMETRIC VIEW

COMMENTS

Channel Stability Debris Management Concerns Obstructions Riparian Zone Valley Wall Processes Etc.

1 Overcast cool showers w/ winds 15 km

DFO / MOE
STREAM SURVEY FORM

Stream Name/Legal: Clearwater Cr. Tributary to Clearwater Cr (Trib A) Access: FT Method:
Watershed Code: 120-421200-83100-16200-0000-000-000-000-000-000 Reach No: Length/Limit:
Location: ~ 55 km Cr. Mouth & Clearwater Rd Map: 94 F/5 Site No: 2 Bankfull/Limit: 20 FT
(Trib A Ck) UTM: 10 [illegible] Plan Card: Y N Field: Hist:
Date Y M D: 96 08 13 Time: 1120 Agency: Crew: [illegible] Photos: KLH 21-22 Air Photos: BCAS 920 81-173

C	PARAMETER	VALUE	METH	SPECIFIC DATA
	Ave Chan Width (m)	2.0	ST	2.1 2.5 1.25
	Ave Wet Width (m)	1.7	ST	1.8 1.5 1.35
	Ave Max Riffle Depth (cm)	55	DP	22, 12
	Ave Max Pool Depth (cm)	55	DP	35
	Gradient %	9	GL	
1	% Pool: Trib: 1 Run: 2 Other: 50		GE	
	Side Chan %	0	GE	
	Debris: Area % 5 Stable % 75		GE	
	COVER Total %	50	GE	
	Cover Type: Ud Piece: 1.00 Source: Veg Den: Veg Bottom:			
	100% 5 DF 0 C 0 20			
	Undercut %: 5 Angle: 25			

BED MATERIAL

Fines	(less than sand, <2 mm)		10
Gravels	small (2-16 mm)	15	10
	large (16-64 mm)	15	30
Larges	small cobble (64-128 mm)	10	20
	large cobble (128-256 mm)	5	20
	Boulder (>256 mm)	0	
Bedrock (R)		0	

C	BANKS					
2	Height: 0.5 Substrate: 20					
	Texture: F S L R					
	Comment:	EN	CO	FC	DC	UC N/A
	Valley Channel Ratio:	1-2	2-5	5-10	>10	N/A
	Active Stage Beach:	Dry	L	M	H	Flood
	Flood Signs: Wash: 0 Shelved: Y N					
	Bank %: 0 Veg: Type:					
	Bank Instability: 5 Type: Length:					

DISCHARGE

Parameter	Value	Method	Specific Data
Wetted Width (m)	1.5	T	1.6 1.4
Mean Depth (m)	0.1	T	0 0.2 0.1 0.2
Mean Velocity (m/s)	0.3	T	0.3, 0.4, 0.2, 0.1, 0.2
Discharge (m³/s)	0.1	T	

REACH SYMBOL
Fish:
Width: Water Channel Slope: Bed Material:

FISH SUMMARY

C	Species	No	Size Range	Life Phase	Use	Method/Ref

STREAM/VALLEY CROSS-SECTION
Looking Downstream
L R

PLANIMETRIC VIEW

COMMENTS

Channel Stability: Debris: Management Concerns: Obstructions: Riparian Zone: Valley Wall Processes: Etc:

1 Site is cascade
2 Fish noted by owner - recent stock

DFO / MOE
STREAM SURVEY FORM

Stream Name (pg): [illegible] Stikine R. Access: F T Map no.:

Watershed Code: [illegible] Reach No.: Length (m):

Location: ~ 490 m [illegible] Site No.: 1 Linear (m): 20 151

Elk Creek Elk Map #: 94 F/5 Flow Card: Y N Field: Hist:

Date: Y M D: 96 08 12 Time: Agency: Crew: Air Photos:

C	PARAMETER	VALUE	METH	SPECIFIC DATA
	Ave Chan Width (m)	2	2	3.5 4.4
	Ave Wet Width (m)	1.9	1.9	3.0 4.1
	Ave Max Riffle Depth (cm)	50	247	40 32
	Ave Max Pool Depth (cm)	—	247	60 40
	Gradient %	2.5	56	
	% Pools / Riffle / Rapids / Other		66	
	Sole Chan %	0 50-0 0-50 >0	66	
	Debris Accum %	0 50-5 5-10 >10	66	
	Stable %	60	66	
	COVER Total %	60	66	
	Cover Type 1 Code / Size / Abund	1 / 5 / 0	66	
	Cover Type 2 Code / Size / Abund	0 / 0 / 0	66	
	Cover Type 3 Code / Size / Abund	0 / 0 / 0	66	
	Cover Closure %	0	6 Algae:	E

C	BED MATERIAL	%
2	Fines (Silt, Clay, Sand <2mm)	30
	Gravels (small 2-16mm)	20
	Gravels (med 16-64mm)	10
	Larges (sm cobble 64-128mm)	0
	Larges (lg cobble 128-256mm)	0
	Larges (boulder >256mm)	0
	Bedrock (R)	0
	Diameter 6 cm Compaction: L M H	

C	BANKS	
	Height (m): R 2.5 Angle: R 60	
1	Feature: (E) S L B	
	Consistency: EN SO FI DC (AC) N/A	
	Veloc. Change Rate: 0-1 1-5 5-10 (>10) N/A	
	Stage: Dry L (M) H Flood	
	Flood Debris (Wrack): Y (N)	
	Bars: N: 0 (0) (Upstream)	
	Water Temp (°C): 6 Turbidity: Conv (25TU):	

DISCHARGE

Parameter	Value	Method	Specific Data
Cross Sec # 4.0 m			
Wetted Width (m)	2.2	2	2.2
Mean Depth (m)	0.5	2	0.5
Mean Velocity (m/s)	0.2	5	0.2 0.2 0.2 0.2 0.2
Discharge (m³/s)	0.22	5	

REACH SYMBOL
(Plan)

Major Veloc. Change: Slope: Bar Width:

FISH SUMMARY

C	Species	No.	Size Range (cm)	Life Phase	Loc.	Method/Ref.

STREAM/VALLEY CROSS-SECTION
(Looking Downstream)

L R

PLANIMETRIC VIEW

COMMENTS

Channel Stability / Debris / Management Concerns / Obstructions / Riparian Zone / Water Well Processes / Etc.

1 [illegible]

2 [illegible]

3 [illegible]

Appendix C

FISH SCALE ANALYSIS

Rainbow Trout Age Determination Completed By:

A.M.C. Technical Services Ltd.
Melinda M. Hirst
6809 Phillip Road.
Lantzville, B.C.
VOR 2H0

Bull Trout Age Determination Completed By:

North / South Consultants Inc.
202-1475 Chevrier Blvd.
Winnipeg, Manitoba
R3T 1Y7

SEE ORIGINAL COPY

FOR SCALE SAMPLE READINGS

ORIGINAL COPY IS HELD BY

B. C. MINISTRY OF ENVIRONMENT, LANDS AND PA

PRINCE GEORGE, B. C.

Appendix D

BATHYMETRIC MAP

Reduced to
34%
of Original Size